

TO: Director, National Institute for Occupational Safety and Health

FROM: California Fatality Assessment and Control Evaluation (FACE) Program

SUBJECT: Backhoe operator dies when run over by his backhoe in California.

SUMMARY
California FACE Report #96CA011

A 46-year old male backhoe operator (victim) died after being run over by the front and rear wheels and the front bucket of his Rollover Protective Structure (ROPS)-equipped backhoe at a construction site. The backhoe was positioned with the right rear tire near the top edge of a 10-foot high slope with the front of the backhoe and its wheels angled to the left, away from the slope. The victim straightened the front wheels and was moving the backhoe forward after completing a section of the trench. The left front wheel of his backhoe struck a rock which caused it to bounce. In attempting to regain steering control, the operator accidentally put the backhoe in reverse. When the rear wheel of the backhoe hit the previously dug trench, it bounced and the operator decided to jump out. The victim tried to jump toward the high side of the slope but rolled and slid down to the bottom of the slope. The backhoe, still travelling backward, came down the slope and ran over him with the left rear tire, then the left front tire and finally the front bucket which was in the lowered position. The operator had been wearing his seatbelt, but took it off when he decided to jump out. The CA/FACE investigator concluded that, in order to prevent future occurrences, employers should:

- Assure that ROPS-equipped backhoe operators stay in their machines, with their seatbelts fastened, when the backhoe seems in danger of rolling over.
 - Ensure that all obstacles, such as large rocks, are removed from the intended path of machinery in operation.
- Manufacturers should:
- Design the shifting lever of backhoes so that a deliberate action is necessary to shift the machine in and out of gear.

INTRODUCTION

On August 8, 1996 at 9:50 a.m. a 46-year old male backhoe operator died when he was run over by his own backhoe during a trench-digging operation. He was run over when he accidentally put the machine into reverse and jumped out in an attempt to get away from the machine before it went over a slope.

The CA/FACE investigator learned of this fatality on August 8, 1996 from the California Division of Occupational Safety and Health (Cal/OSHA) Bureau of Investigation. The CA/FACE investigator inspected the site of the incident on August 9, 1996 and August 12, 1996 at which time photographs of the scene were taken. The CA/FACE investigator met with the owner of the general contracting company and his son, and an environmental consultant for the job. Copies of the Cal/OSHA form 36, police report, coroner's report, and death certificate were obtained by the CA/FACE investigator. The general contractor had 15 employees with 12 on the job site when the incident occurred. The owner of the general contracting company dedicated 15-20 percent of his time to safety. Safety meetings were held every Monday morning with all employees. All contractors' safety representatives met on Wednesdays to discuss safety action items and to introduce new items. Safety information was stapled to each paycheck on every payday. The subcontractor for whom the decedent was working had been on the job site for 5 days. The decedent had worked at the site of the incident for 5 days and had worked for the subcontractor for one year. The subcontractor had been in business for seven years and had 7 employees, with only the decedent working at the site at the time of the incident.

INVESTIGATION

The site of the incident is a wetlands restoration project which requires soil to be removed from an area about 100 yards long by 40 yards wide. At the time of the incident this area had been leveled to about 10 feet below the adjacent banks. A matting, called Bentomat, was to be laid on top of the leveled area and then clean soil was going to be placed on top of the mat. In order to keep the mat in place, anchor trenches needed to be dug on top of each bank. The trenches were to be dug about 15 inches deep, the edge of each mat placed in the trench, and then the trench would be backfilled with soil.

On the day before the anchor trenches were to be dug, a site inspection revealed that the area from which the backhoe needed to be set up for the digging operation was not suitable. A roadway, about 10 feet wide, was graded on top of the bank and then the soil was compacted. The side of the bank, which was sloped at about 45 degrees, was also compacted.

On the day of the incident, the backhoe operator, using the subcontractor's backhoe (**Exhibit 1**), began digging the 15-inch deep trench along the edge of the bank. The trench wall closest to the edge of the bank was about two feet from the bank's edge. The trench was approximately 15 inches wide (**Exhibit 2**). In order to dig the trench close to the edge of the bank, the decedent had to position his right rear tire near the edge of the bank. The front of the backhoe was positioned at an angle away from the bank with its front wheels turned away from the bank. The outriggers were lowered, with the right outrigger positioned on the slope of the bank. The front bucket was always kept in the down position (**Exhibit 3**). When the rear boom-mounted bucket had dug as much trench as possible, the backhoe was moved forward. To do this, the rear boom, which was articulated, was curled into a secure position. The driver's seat was swung from the rear-facing to the forward-facing position. Then the transmission lever was pushed up into forward. The front wheels were straightened and the backhoe was moved forward. It was then backed into the angled working position.

When the incident occurred, the backhoe was attempting to move forward. The operator had placed the transmission into forward but a large, flat rock, about 12 to 15 inches long and 6 to 8 inches wide had fallen in front of the left front wheel. When the left front wheel hit the rock, it pushed it forward instead of running over it due to its flat shape. This caused the backhoe to vibrate and the steering to go somewhat awry. In an attempt to straighten out the steering, the decedent, who had turned his seat half way between the rear operating position and the front driving position (**Exhibit 4**), reached for the steering wheel and accidentally moved the transmission lever, which was located on the left side of the steering wheel (**Exhibit 5**), down into reverse. This caused the backhoe to move backwards. If the engine was revving at the time, not an unusual situation, the backhoe would have moved backward fairly quickly.

As the backhoe moved backward toward the slope of the bank, its right rear wheel fell into the ditch which had been previously dug by the decedent. This caused the backhoe to bounce and the operator, who by now had unfastened his seat belt, was attempting to jump out. The decedent tried to jump on the side away from the bank, but according to a witness seemed to have trouble getting out of the cab, perhaps because he was a very large man. He finally jumped out between the left rear wheel and the rear boom. However, he tumbled and slid down the slope of the bank. He ended up at the bottom (toe) of the slope. The decedent saw the backhoe coming and rose up as if to move. He then laid back down, perhaps because he thought he could position himself so the backhoe would move over him without causing injury. The backhoe which was still moving backward, traveled down the slope of the bank and the left rear wheel ran over the decedent. A witness stated that the decedent attempted to move toward the center of the backhoe and out of the way of the tires. However, the left front tire ran over him and then the front bucket, which was still in the lowered position passed over him. The backhoe never rolled over; it remained on its wheels at all times. The backhoe, after running over the decedent, began running in circles backward on the lower, leveled area. A grader operator who was working on the lower level, ran to the backhoe and stopped its operation. Three other employees ran to the aid of the decedent. The decedent was found bloodied and gasping for air. Nobody touched or moved the decedent because they assumed he had serious internal injuries.

The grader operator, after checking the decedent, ran to the construction trailer to advise the general contractor's owner of the accident. The owner phoned 911 and asked for emergency services. The local fire department and paramedics were dispatched at 9:55 a.m. and arrived at 10:04 a.m. The paramedics found the decedent to have no pulse or spontaneous respiration and pronounced him dead at 10:05 a.m.

CAUSE OF DEATH

The coroner's report stated the cause of death to be multiple blunt force injuries.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should assure that operators of ROPS-equipped backhoes stay in their machines, with their seatbelts fastened, when the backhoe seems in

danger of rolling over.

Discussion: The backhoe operator in this incident had his seatbelt fastened, but removed it and jumped off the machine when it was thought to be in danger of rolling over. His backhoe was equipped with a proper, factory-installed ROPS which is designed to protect the operator's station in the event of a rollover. Had the backhoe operator kept his seatbelt fastened and remained in the cab, he most likely would have suffered little or no injuries.

Recommendation #2: Employers should ensure that all obstacles, such as large rocks, are removed from the intended path of machinery in operation.

Discussion: The backhoe's front wheel struck a large rock which caused it to shake. The operator attempted to regain control by reaching for the steering wheel, but accidentally placed the shift lever in reverse. If the employer had critically surveyed the path of the backhoe and removed all large rocks which could disrupt the intended path of the backhoe, this incident may not have happened.

Recommendation #3: Manufacturers should design the shifting lever of backhoes so that a deliberate action is necessary to shift the machine in and out of gear.

Discussion: The backhoe in this incident had the transmission's shift lever on the left side of the steering wheel. It was positioned close to the steering wheel and just behind its outer rim on a pod extending from the dash. This position makes it possible for a driver to reach over and place the lever in gear, either forward or reverse by reaching just beyond the steering wheel. In this case, the backhoe operator was reaching for the steering wheel and accidentally struck the lever. The backhoe was thrown into reverse which caused it to sway when it dropped into the trench which had been dug just behind it. It then proceeded down the hill because the operator apparently could not regain control. If the shifting lever was designed so a deliberate action was necessary to change its position or if it was placed further away from the steering wheel, this incident may not have happened. The backhoe's manufacturer has been contacted by the FACE investigator and notified of the circumstances regarding the shifting lever.

Richard W. Tibben, CSP
FACE Investigator

Robert Harrison, MD, MPH
FACE Project Officer

Judie Guerriero, RN, MPH

Research Scientist

FATALITY ASSESSMENT AND CONTROL EVALUATION PROGRAM

The California Department of Health Services, in cooperation with the Public Health Institute and the National Institute for Occupational Safety and Health (NIOSH), conducts investigations of work-related fatalities. The goal of this program, known as the California Fatality Assessment and Control Evaluation (CA/FACE), is to prevent fatal work injuries in the future. CA/FACE aims to achieve this goal by studying the work environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact. NIOSH-funded, state-based FACE programs include: Alaska, California, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, Nebraska, New Jersey, New York, Oklahoma, Oregon, Washington, West Virginia, and Wisconsin.

Additional information regarding the CA/FACE program is available from:

**California FACE Program
California Department of Health Services
Occupational Health Branch
850 Marina Bay Parkway, Building P, 3rd Floor
Richmond, CA 94804**